

REMARKS/ARGUMENTS

Summarizing this amendment, the specification has undergone minor corrections of an editorial nature, whereas Claims 1, 8, 12 and 14-18 have been cancelled, Claims 2, 4, 5, 9, 10 and 13 have been amended, Claims 3, 6 - 7 and 11 remain unchanged, and Claims 19 - 22 have been added. Thus, Claims 2 - 7, 9 - 11 and 19 - 22 are now presented for the examiner's consideration.

Considering the drawings first, applicant has reviewed them and cannot find the deficiencies to which the examiner refers. The reference numeral 12 appears only in Fig. 1 where its lead line terminates at a superheater, which is consistent with the specification. The reference numeral 30 appears in Figs. 2 - 6. and in each its lead line terminates at a tube, which is also consistent with the specification. The lead lines from the reference numeral 40, on the other hand, terminate at the tape, which is correct. The reference numeral 26 appears in Figs. 2 and 3, and in each its lead line terminates at the supply header, just as the specification states. Neither the specification nor the drawings contain a reference numeral 20. A copy of the drawings filed with the application is attached.

Turning now to the claims, new Claim 19 is directed to a once-through evaporator for a steam generator. It calls for supply and discharge headers and tubes extending between the headers. It also calls for twisted tapes in at least some of the

tubes. Finally, it calls for water in and flowing through the tubes and headers. As to the condition of that water, the claim specifies that the water in the supply header and the regions of the tubes leading away from the supply header is in the liquid phase, and that the water farther along in the tubes where the twisted tapes are located takes the form of a mist that is directed against the inside surfaces of the tubes by the twisted tapes. Claim 19 sets forth an evaporator that is both novel and unobvious.

The examiner rejected the claims originally presented with the application for describing an evaporator that he considered to be obvious within the meaning of 35 USC 103 from a consideration of US 3,648,754 (Sephton) and US 5,924,389 (Palkes). According to the examiner, it would have been obvious to a person of ordinary skill in the art "to have substituted the evaporator of Sephton for the evaporator section of Palkes for the purpose of converting liquid water into steam in tubes over which hot gases flow." Applicant disagrees, but nevertheless has substituted independent Claim 19 for original Claim 1 and independent Claim 22 for original Claim 8 to better distinguish applicant's once-through evaporator from the Sephton and Palkes patents.

In the Sephton patent Fig. 1 depicts what appears to be a solid wall tube 2 containing a helically twisted ribbon-like baffle 5 that fosters "vortex flow" through the tube 2. Apparently, the tube serves as a conduit for only a liquid, because the patent refers to the "viscosity" of the fluid (col. 2, lines 1 - 29). One normally does not evaluate

gases, such as steam, in terms of "viscosity" Fig. 1 does not appear to disclose an evaporator, much less a once-through evaporator. Figs. 2, 3, 5, 6 and 7 show tubes with perforations and helical inserts in these tubes to facilitate filtration through membranes that line the tubes. Apparently, the helical inserts direct the flow of liquid in the tubes outwardly, so that it passes through the membranes and tube perforations. This is the antithesis of an evaporator for a steam generator. Fig. 4 of Sephton illustrates a heat exchanger having tubes 27 containing helical baffles 26. The tubes 27 pass through a heat exchanger jacket 34 to which their exterior surfaces are exposed. A fluid to be cooled passes through the jacket 34, whereas a coolant fluid passes through the tubes 27, and apparently the coolant fluid is a liquid, because one of its properties is viscosity (col. 4, line 12). To be sure, steam passes through the heat exchanger of Fig. 4, but it is confined to the jacket 34 surrounding the tubes 27. Why else would the steam condense on the outside walls of the tubes 27 as the patent states (col. 3, line 63)? Fig. 4 likewise does not disclose an evaporator. Thus, the Sephton patent has nothing whatsoever to do with once-through evaporators or the problems associated with them, particularly the tendency for the moisture to flow through the centers of the tubes and leave the interior surfaces of the tubes dry. One skilled in the art of designing steam generators and seeking to overcome problems inherent in such heat exchanges would not turn to the Sephton patent for inspiration.

Indeed, the examiner's characterization of the Sephton heat exchanger as an "evaporator" appears to credit more to the Sephton patent than that which is disclosed in it. The Sephton patent does not disclose an evaporator, so one could not logically substitute the "evaporator of Sephton" for the evaporator section of the Palkes patent as the examiner contends.

Other references, such as US 5,799,622 (Waldner), show hot gases flowing through tubes filled with helical inserts. No mist is present in the gases.

The Palkes patent, which does pertain to once-through evaporators for steam generators, suggests rifling in the tubes of such evaporators to create additional flow turbulence and delay the onset of the dryout of the tube walls (col. 3, line 60). US 6,446,580 (Franke) and US 5,662,070 (Kastner) likewise show rifling in the tubes of evaporators.

While rifling seems to be reasonably well known for producing turbulence in the tubes of evaporators for steam generators, rifling is not the same as twisted tapes and does not suggest twisted tapes. Moreover, one skilled in the art would not turn to prior art that teaches twisted tapes in purely liquid flow streams or in purely gaseous flow streams for inspiration, or in other words, in an apparatus that cannot be characterized as a once-through evaporator. In purely liquid flow streams the interior surfaces of the tubes are constantly wet, so the problem posed by the conversion of liquid water into a

mist does not exist. On the other hand, in purely gaseous flow streams the insides of the tubes are constantly dry and should be dry, for to wet the tubes would most likely contaminate the gas and could also adversely affect heat transfer characteristics. The conversion of water into saturated steam within the tubes of a once-through evaporator presents a unique problem — particularly the tendency of the mist that emerges from the boiling water in the tubes to remain in the centers of the tubes, causing the walls of the tubes in the regions that contain the mist run dry. See the paragraph bridging pages 7 and 8 of the application. The fact that liquids or pure gases are deflected outwardly in tubes with twisted tapes, does not really address the problem solved by applicant or suggest a solution to it. The only attempted solution heretofore available resides in rifling, but rifling is not twisted tapes, nor is it as effective.

In evaluating obviousness — or the lack of it — one may consider whether or not references provide some suggestion or motivation to combine them to produce that which is claimed. Here, the motivation is completely absent. The Sephton patent, which does not disclose an evaporator, would motivate one to use a twisted tape to drive a pure liquid outwardly in a tube, primarily to effect better filtration of the liquid through a membrane that lines the tube. That would not motivate someone of ordinary skill to use twisted tapes in a tube where water is converted into saturated steam in an evaporator. By the same token, twisted tapes in a purely gaseous environments would

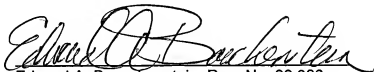
not motivate one to use them where the object is drive moisture outwardly against a tube wall to wet the wall. Rifling in the tubes of an evaporator does not invite one to use twisted tapes. Indeed, with three references showing rifling in evaporator tubing, one would expect to see twisted tapes as well if twisted tapes were so obvious. Hence, Claim 1, which is confined to a once-through evaporator having tubes and twisted tapes as well as water in the tubes, with the water being in the liquid phase at the entrance to the tubes and farther along in the region of the twisted tapes being in the form of a mist, is not rendered obvious by the Sephton and Palkes patents.

The same hold true for Claims 2 - 7, 20 and 21, which depend from Claim 19. Independent Claim 22 is much the same as independent Claim 19, but includes other components of a heat recovery steam generator. It is believed allowable for the reasons advanced in connection with Claim 19, as are Claims 9 - 11, which depend from Claim 22.

Appl. No. 10/677,443
Amdt. dated July 2, 2007
Reply to Office action of April 2, 2007

In view of the foregoing, favorable consideration and allowance of the application with 14 claims — namely, Claims 2 - 7, 9 - 11, 13, and 19 - 22 — are respectfully requested.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Edward A. Boeschstein', written in a cursive style.

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